

PROVISIONING DATA LINK CONNECTION IDENTIFIERS  
IN A COMMUNICATIONS NETWORK

BACKGROUND OF THE INVENTION

Field of Invention

[0001] The present invention relates generally to communications services and, more particularly, to a system and method for provisioning data link connection identifiers in a communications network.

Description of the Background

[0002] A frame relay network relies on virtual connections to support the exchange of data through an intervening network from an originating system to a remote destination system. A permanent virtual connection, or PVC, refers to a connection that remains established even when data are not being sent. A data link connection identifier (DLCI) is a number used to identify a PVC endpoint in the frame relay network. The DLCI is contained in a 2-byte header that attaches to data frames passing through the network, allowing the frames to be sent to their proper destinations. The DLCI has local significance only, meaning that each PVC on a particular physical port must have a different DLCI number. The DLCI may be the same or different from the DLCI used at the other end.

[0003] To configure a new circuit, network technicians typically query a network management application to obtain a list of the assigned DLCIs for a certain physical or logical port. While network technicians working in, for example, a data customer support center (DCSC) have access to the network management application, service consultants (SCs) and

system designers (SDs) working in the field do not. Consequently, the SCs and SDs must contact the DCSC to provision a DLCI for a new circuit. Typically, the SCs and SDs call the DCSC to obtain, usually by fax, a list of PVCs connected to a certain network element. The SCs and SDs then use the list of assigned DLCIs to select a new one for the new circuit. The process of transmitting this information to offsite personnel is resource-intensive and procedurally inefficient.

[0004] A system and method for provisioning DLCIs in a communications network is needed that allows SCs and SDs access network configuration information in a simple and convenient manner. The architecture should provide sufficient flexibility so that SCs and SDs can access this information in a timely fashion while minimizing the burden on DCSC staff members.

## SUMMARY OF THE INVENTION

[0005] The present invention is directed to a system for remotely displaying network configuration information, the system comprising a frame relay network comprising at least one permanent virtual connection, wherein the permanent virtual connection has an endpoint associated with a data link connection identifier (DLCI); a network management system, in communication with the frame relay network, capable of storing the DLCI; and a remote access module, in communication with the network management system, capable of remotely displaying the DLCI.

[0006] The system of the present invention may be used, for example, to provision data link connection identifiers in a communications network. For example, the present invention may be used in the provision of communications services to create a new permanent virtual circuit or PVC in a frame relay network. A permanent virtual connection, or PVC, refers to a

connection that remains established even when data are not being sent. A data link connection identifier (DLCI) is a number used to identify a PVC endpoint in the frame relay network. The DLCI is contained in a 2-byte header that attaches to data frames passed through the network, allowing the frames to be sent to their proper destinations. Where each PVC on a particular physical port must have a different DLCI number, the present invention may be employed to provision a DLCI for a new PVCs that differs from those DLCIs already assigned to existing PVCs.

#### DESCRIPTION OF THE FIGURES

[0007] For the present invention to be understood clearly and readily practiced, the present invention will be described in conjunction with the following figures, wherein:

[0008] FIG. 1 is a simplified schematic diagram of a system for provisioning data link connection identifiers in a communications network according to one embodiment of the present invention;

[0009] FIG. 2 is an exemplary web page for accepting a logical or physical port name in connection with a DLCI query, according to one embodiment of the present invention;

[0010] FIG. 3 is an exemplary web page for communicating the results of the DLCI query to the user, according to one embodiment of the present invention; and

[0011] FIG. 4 is a simplified schematic diagram of a system for provisioning data link connection identifiers in a communications network according to another embodiment of the present invention.

## DETAILED DESCRIPTION OF THE INVENTION

[0012] It is to be understood that the figures and descriptions of the present invention have been simplified to illustrate elements that are relevant for a clear understanding of the present invention while eliminating, for purposes of clarity, other elements. For example, certain details of a communications network are not described herein. Those of ordinary skill in the art will recognize, however, that these and other elements may be desirable in a typical communications network. A discussion of such elements is not provided because such elements are well known in the art and because they do not facilitate a better understanding of the present invention.

[0013] FIG. 1 is a simplified schematic diagram of a system 10, according to one embodiment of the present invention, for provisioning data link connection identifiers in a communications network. The system 10 includes a web client 12, a web server 14, a network management module 15, a network management system 16, a network access device 18, and a frame relay network 20. The system 10, as discussed further below, provides remote access to network information such as the DLCIs for a particular physical or logical port. According to the present invention, users may access the network management system 16 by using either conventional means, such as the network access device 18, or the web client 12, which may reside outside of an internal network. Those skilled in the art will appreciate that the network access device 18 in FIG. 1 is shown simply to illustrate a conventional access path and does not form part of the invention.

[0014] The web client 12 may be any device capable of visually presenting the information received from the server 14. According to one embodiment, the web client 12 stores a number of computer programs, including a “browser,” such as Netscape Navigator. As known in the art, a browser is used to communicate with the web server 14 and to visually present the

information received from such a server. Those skilled in the art will recognize, however, that other web clients can be used without departing from the principles of the invention, provided such clients are compatible with the system 10 and are able to perform the steps of the provisioning method, as described below. In addition, although the invention is discussed in the context of a client-server type of communication model, it should be understood that the principles of the invention are equally applicable to peer-to-peer networks.

[0015] Web server 14 refers to one or more server computers of the type well known in the art. The server 14, which may have local storage, may store the network management module 15 to minimize system latency. According to one embodiment, module 15 may be implemented as a web site. One of ordinary skill in the art will realize, however, that module 15 may be implemented at any level, ranging from hardware to application software.

[0016] The network management module 15 may be implemented as software code, to be executed on any suitable hardware device such as the web server 14, using any suitable computer language such as, for example, Java, HTML, C or C++ using, for example, conventional or object-oriented techniques. The software code may be stored as a series of instructions or commands on a computer readable medium, such as random access memory (RAM), read only memory (ROM), a magnetic medium such as a hard-drive or a floppy disk, or an optical medium such as CD-ROM. According to one embodiment (not shown), the module 15 may reside on a physical device separate from the web server 14.

[0017] The network management system 16 may be a centralized network management application, such as NavisCore™ by Lucent Technologies, for managing the network elements in the frame relay network 20. The network management system 16 harvests statistics and other network information from the network 20 in-band over the network or, as shown in FIG. 1, over

an out-of-band network using a network management protocol such as simple network management protocol (SNMP).

[0018] The frame relay network 20 is comprised of a plurality of network elements, including switches, connected using permanent virtual circuits (PVCs). It would be apparent to one skilled in the art that the network 20 can be configured in ring, full mesh, or partial mesh topologies, or combinations thereof without departing from the principles of the invention.

[0019] According to the present invention, the web client 12 is coupled to the web server 14 and communicates using, for example, the Hypertext Transfer Protocol (HTTP), which is a known application protocol that provides users access to files (e.g., text, graphics, images, sound, video, etc.) using a standard page description language, such as HTML. The web server 14 is coupled to the network management system 16 over a local area network (LAN) 22. The LAN 22 may be implemented using, for example, packet-switched Transmission Control Protocol/Internet Protocol (TCP/IP) over an Ethernet, Fast Ethernet or Token Ring network. The network access device 18 is also coupled to the network management system 16 via the LAN 22. Finally, the network management system 16 is coupled to the network 20 over, for example, a high-speed connection such as a T1 line. Those skilled in the art will appreciate that the hardware and software interfaces between elements shown in FIG. 1 are conventional and do not form part of the invention.

[0020] The present invention operates in the above-described environment to facilitate provisioning data link connection identifiers in a communications network. First, using the web client 12, the user inputs a URL (Uniform Resource Locator) to invoke the network management module 15. The URL represents the address of the entry point to the web site embodying module 15 (e.g., the home page for the web site). Upon entering the URL, the web client 12

makes an HTTP request to the web server 14 hosting the module 15. The web server 14, in turn, processes the request and supplies the client with the requested information in an HTML formatted web page.

[0021] After the user connects to the web server 14, an authentication process will occur. The authentication process may be a user directed process using, for example, a login and password protocol. User access to the network management system 16 can be associated with an access level determined by a user login or other user validation. Multiple access levels may be used, for example, to permit administrator rights to certain users and limit others to read-only access. In general, the process of reading and authenticating a username and password is well known to those skilled in the art.

[0022] FIG. 2 is an exemplary web page 50 for accepting a logical or physical port name in connection with a DLCI query, according to one embodiment of the present invention. Once logged in, the module 15 transmits the web page 50 to the display of the web client 12 and awaits input from the user. The user then inputs a logical or physical port name and submits that information to module 15. Module 15, in turn, compiles a list of PVCs associated with the specified port and transmits the results to the display of the web client 12.

[0023] FIG. 3 is an exemplary web page 60 for communicating the results of the DLCI query to the user, according to one embodiment of the present invention. The web page 60 may comprise, for example, nine columns including the source switch 62, the source logical port name 64, the source DLCI 66, the destination switch 68, the destination port 70, the destination DLCI 72, the destination service type 74, and the committed information rate 76. The first four columns 62, 64, 66, and 68 identify the characteristics of an originating system. The source switch 62, port 64, and DLCI 66 identify the physical and logical locations of the PVC. The

source service type 68 refers to the type of service available on a certain PVC, such as frame relay or ATM. Likewise, the next four columns 70, 72, 74, and 76 identify the same characteristics of a remote destination system. The last column of web page 60 identifies the committed information rate or CIR 76, which refers to a bandwidth (expressed in bits per second) associated with a logical connection in a PVC. One skilled in the art will appreciate that the source and destination information shown on the web page 60 is merely representative and may require customization, such as to comply with customer proprietary network information (CPNI) regulations, without departing from the principles of the invention.

[0024] A service consultant (SC) or service designer (SD) then uses this information to select an unassigned DLCI for a particular logical or physical port. For example, referring again to FIG. 3, an SC or SD will select a DLCI not listed in the column 66, when setting up a source-side PVC, or in column 74, if setting up a destination side PVC. For the source port 70QGDA500000\_LMC, the SC or SD could choose a source DLCI of, for example, 450. Likewise, the SC or SD could use the same DLCI, 450, for the destination-side of the PVC because only 701 is assigned and DLCIs have local significance only.

[0025] FIG. 4 is a simplified schematic diagram of a system 100 according to another embodiment of the present invention. The system 100 includes a plurality of web clients 102, a virtual private network (VPN) 104, a router 106, the web server 14, the network management system 16, a router 108, and a plurality of frame relay networks 110. The present invention sends requests from the web clients 102 to the web server 14 via the VPN 104, which interconnects end user locations using encrypted traffic sent via "tunneling" over the Internet.

[0026] According to the embodiment illustrated in FIG. 4, the web clients 102 may access the web server 14 using a variety of edge access methods including, for example, a cable



modem, a digital subscriber line, or a dial-up modem. The web clients 102 establish a secure connection to the web server 14 using, for example, an extranet client over the VPN 104. The VPN 104 is coupled via firewall 105 to the router 106. The firewall 105 is a system, usually a combination of hardware and software, that enforces a security policy on communication traffic entering and leaving the internal network. Beyond the firewall, the communication traverses through the network, as described above, to reach the network management system 16. The network management system 16, in turn, communicates with the plurality of frame relay network over a LAN 23.

[0027] It should be understood that the invention is not limited by the foregoing description, but embraces all such alterations, modifications, and variations in accordance with the spirit and scope of the appended claims.